RECENT TRENDS IN PROTECTION OF HARVESTED BAMBOOS FROM GHOON BORERS[1]

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In India, harvested bamboos suffer in varying degrees, from different species of ghoon borers at the felling site and under storage conditions. Severely infested bamboos are often reduced to heaps of dust, causing a colossal loss in revenue to the growers and the industry. Protection of bamboos has been an important thrust area of forest research since World War II. The Forest Research Institute, Dehradun, has played a pioneering role in developing appropriate technologies for protecting bamboos from insects both for short (prophylactic treatment) as well as long duration (preservative treatment).

This paper discusses the results of some of the recent researches carried out at the Forest Research Institute, particularly on the use of synthetic pyrethroids which, though easily biodegradable, have been found highly effective as prophylactic measures against ghoon borers.

Introduction

Bamboo, commonly referred to as green gold, is one of the most important and precious non-wood forest raw materials. According to one estimate (Tewari, 1992), roughly 14 million ha of the earth's surface is covered with bamboo forests, a major portion (*ca* 80%) of which occurs in Asia with 65 genera (14 endemic) and 900 species. India perhaps is one of the leading countries with an average annual production of nearly 3.23 million tonnes (Pathak, 1989). In fact India with nearly 23 genera and 125 species, both indigenous and exotic, is considered to be one of the largest bioreserves of bamboo gene pool in the world, occupying roughly an area of 10.23 million ha. Thus, the need to propagate and protect such a vast and precious natural resource needs no further emphasis.

Borers of felled and stored bamboos

In India, all species of bamboo suffer in varying degrees, from insect pests and other biological agencies at the felling sites, during transportation, storage and even as finished products in use. While none of the 40 and odd species reported by Singh and Bhandari (1988), Mathew and Nair (1988) and 15 species of termites (Thakur, 1988) cause direct mortality in green standing bamboos, coleopteran borers (*ca* 32 species) are principally responsible for serious infestation and economic loss in the field and in stored bamboos. The most important among them are the common ghoon borers (3 species) of the genus *Dinoderus (viz. D. brevis, D. minutus* and *D. ocellaris), Heterobostrychus aequalis* and *Sinoxylon anale* (Coleoptera:Bostrychidae) and one species of Cerambycid borer, *Stromatium barbatum.*

Incidence of borer damage in bamboos

Except for some recent work on 13 species of bamboos at Forest Research Institute, Dehra Dun, no authentic data are available on the natural durability of most bamboos. However, it is acknowledged that bamboos, in general, are highly susceptible and are easily attacked by insects (borers and termites) and fungi. This is especially true in tropical countries, where high temperature and humidity are ideal for insect infestations.

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The felled bamboos remain in storage for varying periods, from one month to a year or even more. It is in these storehouses that the harvested and stored bamboos, if not protected adequately, are likely to be infested, often seriously, by insect borers, and reduced to heaps of powdery dust, causing considerable loss in revenue to the growers and to industry.

Some laboratory and field case studies have revealed over 22% loss in wood substances in one year, with a resultant *ca* 10% fall in unbleached kraft yield during storage (Guha and Chandra, 1979). Such losses can be brought down to around 7% by suitable treatment. However, losses in the field or open storage in timber depots are invariably much higher because of hot and humid conditions prevailing in most parts of the country (Kumar *et al.*, 1985). Though data on such losses are not always available, it is presumed that it must be quite high, particularly at sites with poor storage conditions, where losses upto 30-40% of the stock have been reported (Kumar, 1977). In another study, carried out recently by FRI at Jaffrabad Forest Dept, (U.P.) (unpublished data) nearly 40% (0.15 million kodis) of the stacked bamboo revealed very high incidence of borer attack, with a resultant nett loss of approximately 4.6 million rupees to the department.

Protection of bamboo against ghoon borers

The enormous demand for bamboo poles during the Second World War and their proven susceptibility to biodegradation, is an important question for the protection of bamboos, more particularly from ghoon borer attacks. The then Entomology Branch of Forest Research Institute was assigned this problem. Since then, FRI has been playing a pioneering role in developing economically appropriate control measures. The Entomology Division has, however, been concentrating only on prophylactic measures for protecting bamboos at the felling site or the storage depots.

The traditional strategies

Beeson (1941) published detailed life histories and control measures of major ghoon borers, *viz. Dinoderus brevis, D. minutus* and *D. ocellaris.* Gardner (1945) published a detailed note on the biology and control of bamboo borers. After independence Roonwal and Chatterjee (1951), Roonwal *et al.* (1959), Singh and Bhandari (1988), Thakur (1988), Mathew and Nair (1988) and more recently Thapa *et al.* (1992) have dealt with this problem extensively, particularly on the nature and incidence of damage with appropriate control measures, some of which being currently under use, are discussed:

The Safe Felling Period

There is strong circumstantial evidence that the susceptibility and attraction of bamboos to ghoon borer attack depends primarily upon the age and season of felling, as also due to presence of starch, certain soluble carbohydrates and proteins, which are the essential food component of the developmental stages of Bostrychid and Lyctid borers. It is perhaps due to this very low starch concentration in flowered bamboos that they are more resistant to ghoon borer attack (Tewari and Singh, 1979).

Studies carried out by various investigators (Beeson, 1941; Gardner, 1945 and Mathur, 1958) indicated considerable variation in starch content in various species of bamboos in different localities, and a corresponding variation in their susceptibility to borer attack. The dictum that cold winter months are the best period for felling bamboo is only partially true, as it does not guarantee complete immunity from borers. The low incidence of infestation is due to a low and less active borer population during this period. This dictum has relevance perhaps only to southern India and possibly in localities where *Dendrocalamus minutus* is a predominant species (Beeson, 1941).

In northern India (Western U.P.), the best period for felling is between the end of monsoon (i.e. end of August) to the end of December, though in Doon Valley (*D. brevis*) the dates differ slightly. Here, borer attack is least on fellings carried out during late summer (mid June) to early monsoon (end of July). The incidence is low between mid October to end of December. The bamboos felled during the first five months, especially those of March and April, are prone to severe borer damage. Northwest India, comprising the states of Punjab, Himachal Pradesh and Jammu (J&K) has *Dendrocalamus ocellaris* as the predominant species. The safest felling period is May and December, but the felling schedules carried out from end of October to mid January are also fairly good, a practice schedule which is even now in vogue in this part of the country. It is believed that the starch content of the wood at this time is extremely low, almost nil or in traces.

Water soaking

It is a common belief among the forest dwellers that soaking bamboos in water, for a varying period, imparts immunity against ghoon borers and *Lyctus* attack, as a result of leaching of starch, soluble sugars and other substances in bamboos. In view of this, a series of experiments were conducted at the FRI and it was concluded that water immersion for 12 weeks or so protects bamboos from Bostrychid borers. However, this treatment does not provide any protection against *Lyctus* attack.

Culm baking procedure

Baking of culms is a customary practice in certain areas of the country. The procedure involves coating of culms with rape seed oil and then heating them over the fire for a varying period. This process also leads to straightening of the culms. Experiments revealed that this heat treatment results in fixing of the starch in the tissues and, if performed soon after felling, can check natural starch depletion. Prolonged heating for a period of six hours or so renders the culms immune to borer attack due to reduction in moisture content (upto 0-5%) which is insufficient and too low to support Bostrychid larval development (Gardner, 1945).

Chemical control

Notwithstanding the several attempts to protect bamboos from borer attack in the past, the problem persists in challenging form and the bamboos continue to suffer serious insect attack both at the felling site and under storage conditions. The FRI has been conducting experiments to evolve a suitable protection umbrella against insect borers infesting felled bamboos in depots.

Prophylactic spray of 0.33% BHC in kerosene oil provided protection to bamboos against all categories of borers in stacked bamboos, however a dosage of 0.5% BHC in kerosene oil was found to be the most effective prophylactic (Roonwal and Chatterjee, 1951; Roonwal *et al.*, 1959).

In subsequent years, salts and toxic chemicals of later generations were introduced. Prophylactic treatment of stacked bamboos with 1% lindane, 3% boric acid + borax (1:1), 3% boric acid + zinc chloride were reported to be effective against post-harvest insect attack. It was also reported that dip treatment of green bamboo culms for varying period in chemical solutions of the above compounds was more effective than simple spray treatment and that it should be carried out before the summer monsoon (Tewari and Singh, 1979).

Current trends

The discovery of synthetic pyrethroids, a highly effective yet easily biodegradable group of insecticides, further revolutionised pest control technology. Recently, Thapa *et al.* (1992) have

TABLE 1

SUMMARY OF OBSERVATIONS ON GHOON BORER ATTACK ON TREATED AND CONTROL (UNTREATED) BAMBOO STACKS AT THREE DIFFERENT LOCALITIES

Month of observation & period of experiment	Degree of ghoon attack																											
	Cypermethrin									Fenvalerate									Endosulfan						Control			
	0.1% in diesel oil			0.2 % in diesel oil			0.4 % in diesel oil			0.1 % in diesel oil			0.2 % in diesel oil			0.4 % in diesel oil		0.5 % in water			1.0 % in water		1.5 % in water					
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C′	A	B	A	B	C	B	C	B	C	A	B	C
April 88	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F	4F
June 88	4L	4L	4F	4L	4F	4F	4L	4L	4F	4L	4L	4F	4L	4L	4F	4L	4L	4L	3F, 1L	4F	4F	4F	4F	4F	4F	4L	4L	4L
August 88	4M	4H	4L	4M	1F, 3L	1F, 3L	4L	1L,	3MH	2F, 2L	4MH	4H	4L	4MH	2M, 2H	1F, 3L	4H	4L-M	4L	4M-H	4L	4M-H	4L	3L-M, 1H	1F, 3L	4F	4H	4H
October 88	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H	4H

Abbreviation used:

F: Free L: Light M: Moderate H: Heavy

Replications (each treatment): Four

Localities: A: Jaffarabad (U.P.)

B: Chandimandir (Chandigarh)

C: Jagadhri (Haryana)

concluded that while fenvalerate, when applied in doses of 0.4% e.c. formulation in diesel oil failed to protect bamboos from ghoon borer attack, the other synthetic pyrethroid, cypermethrin, proved fairly effective at the same dosage and provided protection to bamboos stored in open for about 4-5 months until the monsoon when the insecticides are likely to get washed out from the smooth surface, leaving little residue on the culms. Similarly, endosulfan (35 e.c.), when sprayed at dosages of 0.75-1.5% concentration in diesel oil with a small quantity of sticker (triton) is reportedly effective against borer attack for the same period as synthetic pyrethroids. More experiments have been laid for increasing the efficacy of the prophylactic treatments by adding some commercially available sticking agents such as teepol, triton, Neogen PEN and Neogen PAN, molasses, etc. to cypermethrin spray emulsions. Though final data are still under analysis, indications are that the use of Neogen PEN and molasses, added to cypermethrin, can give adequate protection for about a year to bamboo stored in the open.

Discussion

Investigations carried out at the FRI have indicated that methods such as soaking, sap displacement or diffusion treatments, etc., if carried out as per the specified schedules, are simple, cheap and quite effective for protection of bamboo. The prophylactic treatment is of temporary nature and is suitable for protecting bamboo in storage, before it is put to use. The efficacy of the treatment wanes and is proportional to the period of storage. The incidence of borer attack tends to increase with passage of time as a result of decrease in residual toxicity of the insecticide. Thapa *et al.* (1992) have recommended stacking of bamboos under temporary shed for longer and safe storage. Further innovative trials to improve storage conditions in depots are, however, necessary.

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